Fig. 1.

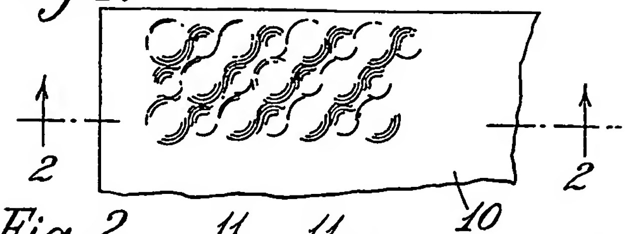



Fig. 2.

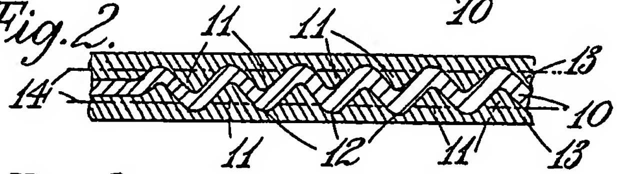



Fig. 3.

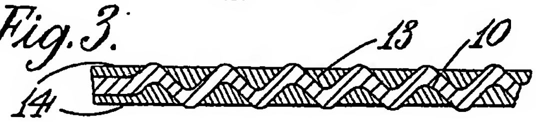



Fig. 4.

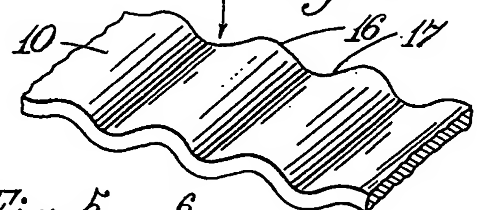



Fig. 5.

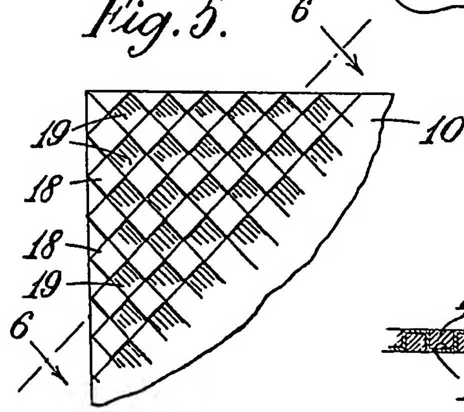
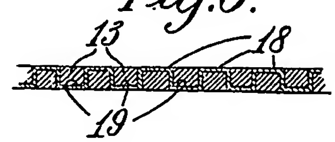
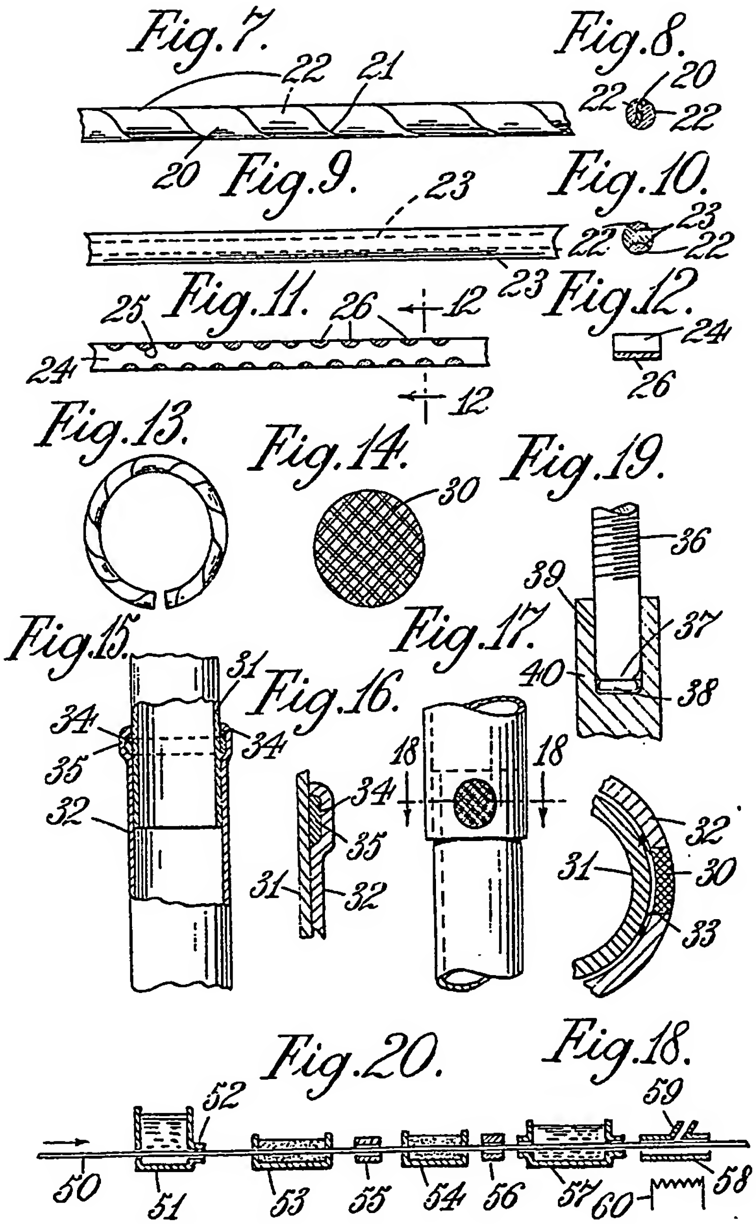


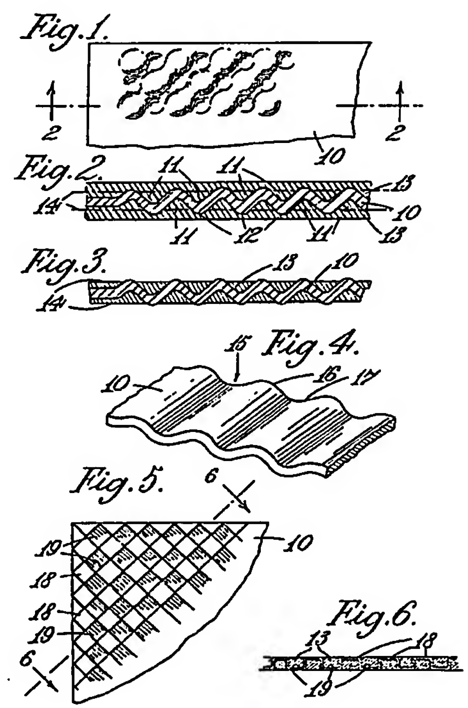

Fig. 6.

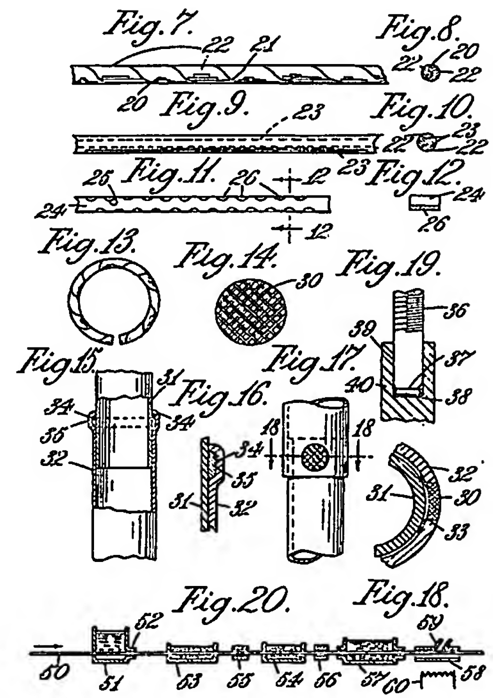


692,710 COMPLETE SPECIFICATION
2 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2



692,710 COMPLETE SPECIFICATION
2 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2



PATENT SPECIFICATION

Inventor: JOHN COCKBAIN BRIGGS.

692,710

Date of filing Complete Specification (under Section 16 of the Patents and Designs Acts, 1907 to 1946): April 4, 1951.

Application Date: April 12, 1950. No. 8952/50.

Application Date: Aug. 16 1950. No. 20291/50.

Application Date: Oct. 31, 1950. No. 26599/50.

Complete Specification Published: June 10, 1953.

Index at acceptance:—Class 83(iv), S(2g: 3).

COMPLETE SPECIFICATION

# Improvements in or relating to Self-Fluxing Solders

We, THESSCO INDUSTRIAL RESEARCH LIMITED, a British Company, of Royds Mill Street, Sheffield, 4, Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to self-fluxing solders, i.e. hard and soft solders preloaded during manufacture with flux for use in making a joint with the solder.

The invention is particularly, though not exclusively, concerned with silver solders.

A common self-fluxing solder is formed as a hollow rod having a core of paste-like consistency. During soldering, it is highly desirable that the flux shall melt and run over the surfaces to be joined before the solder itself melts and begins to flow. With flux-cored solder, as heat is applied externally, there is a liability for the solder itself first to flow, or for the flux and solder to melt and flow simultaneously. A flux-cored solder would be in general quite unsatisfactory for the making of a soldering component (e.g. a ring) formed to the shape of a joint (e.g. an annular joint) to be made, because the flux can flow only from the ends of the core, so that flux would not spread over the whole surface area of the joint prior to the flow of the molten solder.

It has been proposed to provide a welding rod on its outside surface with a plurality of spaced recesses extending around and length-wise of the rod; and fluxing material substantially fills the recesses, the peripheral surface of the rod being bare of flux. The functions of flux in welding and soldering operations are different; and in welding the flux crumbles and falls away. It has also been proposed to provide solder wire of circular section with a coating of flux, and to form solder wire with one or more spiral flutes or serrations filled with flux.

The main objects of the present invention are to provide an improved self-fluxing solder and improved components of self-fluxing solder for making a soldered joint.

A further object is to provide an improved self-fluxing solder or solder components for use in electrical resistance brazing.

Another object is to provide methods for manufacturing the self-fluxing solder and components.

According to the main feature of the present invention self-fluxing solder comprises a solid body of solder formed with an external surface having a spreading recess or recesses, said recessed surface carrying an external body of adherent flux of solid or semi-solid consistency, which is distributed over the recessed surface so as to fill the recess or recesses therein, and which is alone sufficient in quantity to permit the making of a soldered joint with the solder, and a vehicle for bonding together the particles of flux and causing them to adhere to the solder body, the vehicle being of such a nature that it is stable in form and composition under normal temperatures, affords a stiff and durable body of flux under normal temperatures, and substantially all vaporizes when the soldering temperature is reached, any small residue not being deleterious to the joint to be made.

In one convenient form, the body of solder is shaped as sheet or strip. One or both surfaces is recessed to receive the flux.

The recessed surface may be afforded

by a multiplicity of closely-spaced depressions extending over the whole surface of the solder body. Thus the surface may be formed by dimples; by parallel grooves and ridges, which in the strip may be set transversely; by a criss-cross arrangement of ridges and grooves; or by corrugations.

The dimpled or other form of strip may conveniently be made by passing plain sheet or strip between rollers bearing the requisite pattern for producing the recessing.

In another form of the invention, the body of solder is shaped as a wire or rod. The recessing for receiving the flux may be in the form of a helical groove produced as by twisting a wire or rod of suitable section, e.g. of non-circular shape, about its axis. Two or more wires may also be twisted together to produce a unit having a plurality of helical grooves between the individual wires for receiving the flux. The recessing may also consist of one or more longitudinal grooves or flutes in the wire or rod.

The flux is applied to the recessed surface of the solder body in combination with a vehicle, which is stable in normal temperatures, in which it may be in suspension and/or solution. The vehicle acts to bind together the particles of flux into a stiff and durable body in normal temperatures and also to cause the flux to adhere to the solder. The nature of the vehicle must also be such that it does not retard the action of the flux by reducing the surface tension of the molten solder; nor must it leave when heated to vaporize during the soldering operation any residue deleterious to the making of a satisfactory joint. It is also desirable that the flux particles shall be sufficiently bonded together by the vehicle to prevent disintegration or removal of the flux by handling; that the flux shall withstand limited bending, or even stamping in certain circumstances; and that the vehicle shall protect the flux against atmospheric conditions.

A suitable vehicle consists of a thermoplastic plasticized resinous composition consisting of polybutyl methacrylate. The composition may incorporate a plasticizer such as dibutyl phthalate. To produce a balanced composition, i.e. one in which the flux particles are evenly distributed, a suitable solvent may be added to the thermoplastic composition before mixing in the flux. The consistency of the flux product, when ready for application to the solder, is preferably that of paint. Any tendency to gel is to be avoided. The flux product is applied in any suitable way, as by dipping or spraying.

In one embodiment of the present invention the solder may be preformed into a component shaped to the form of the joint to be made. Thus, the solder may be shaped as a ring adapted to fit into an annular space at the joint between two mating parts such as two telescoped tubes that are to be joined by a soldering operation. Alternatively, the solder may be preformed into a component shaped to the form of a disc adapted to be inserted in a hole of a part (e.g. a tube) to be joined to another and adjacent part (e.g. another tube) overlying the hole. The solder may also be preformed into a component shaped as a cap adapted mechanically to be fixed over the end of a stud or rod or the like for joining that end to another part by a soldering operation

For electric resistance soldering it is necessary for there to be a current flow between the electrodes through the solder. As the flux is normally an electrical insulator, the surface of the solder must therefore be exposed, at least in part.

Various ways of putting the invention into practice are illustrated by way of example in the accompanying drawings, in which:—

Figure 1 is a plan view of a portion of solder sheet or strip formed with dimples on both upper and lower surfaces.

Figure 2 is a sectional view on the line 2—2 of Figure 1, showing layers of flux covering both surfaces of the solder sheet or strip.

Figure 3 is a sectional view similar to Figure 2, showing the flux at lower levels such that the peaks on the dimpled solder sheet or strip are exposed.

Figure 4 is a perspective view of a portion of solder sheet or strip shaped to corrugated form.

Figure 5 is a plan view of a solder sheet rolled or otherwise formed at both surfaces with a multiplicity of stud-like projections.

Figure 6 is a sectional view of Figure 5 on the line 6—6.

Figures 7 and 8 are respectively side and end views of a solder wire or rod formed with a spiral groove which is filled with flux.

Figures 9 and 10 are side and end views of a solder wire or rod formed with two longitudinal grooves or flutes disposed at diametrically opposite sides of the wire or rod and filled with flux.

Figure 11 is a side view of a strip of solder formed at both surfaces with transverse grooves filled with flux.

Figure 12 is a sectional view of Figure 11 on line 12—12 thereof.

Figure 13 is a face view of a ring formed from a length of the self-fluxing

solder wire or rod shown in Figures 7 and 8.

Figure 14 is a plan view of a disc of self-fluxing solder.

Figure 15 is a sectional view of the application of a solder ring component for joining together two telescoped tubes.

Figure 16 is a fragmentary view in section of the joint of Figure 15 shown to an enlarged scale.

Figure 17 is a view in elevation showing the application of the self-fluxing solder disc shown in Figure 14 to the joining of two telescoped tubes.

Figure 18 is a fragmentary sectional view on an enlarged scale on the line 18—18 of Figure 17.

Figure 19 shows a stud fitted at one end with a cap made from the self-fluxing solder for use in fixing the stud in a hole; and

Figure 20 is a diagrammatic view showing a method of coating wire with flux by a continuous process.

Referring first to the form of self-fluxing solder shown in Figures 1 and 2, a sheet or strip of solder 10 of thin gauge is passed between rollers adapted to impress dimples 11 into both surfaces of the solder sheet. In producing a dimple 11 at one surface, there is afforded a peaked projection 12 at the other surface of the sheet. The dimples are evenly distributed over the surfaces of the sheet at a requisite pitch. A pitch of $\frac{1}{16}$th of an inch has been found satisfactory. Both surfaces of the solder 10 are coated as by spraying or dipping with layers of flux 13. The level of the flux layers is such as completely to fill the dimpled recess 11 and cover the peaks 12.

For electrical resistance soldering, it is necessary to have an electrical circuit through the solder between the two contacts. The body of flux at the two surfaces of the solder 10 is therefore brought down to a level, as by scraping to the levels 14, in order to expose the peaks 12. The self fluxing solder then has the form shown in Figure 3. It has been found that it is not necessary completely to expose all the peaked surfaces of the solder.

With the form shown in Figure 4, a sheet or strip 10 of solder is formed with corrugations 15 having ridges 16 and longitudinal grooved recesses 17. Flux is spread over both surfaces of the solder 10 so as substantially to fill the grooves 17 or alternatively to completely fill these grooves and also afford a thin layer covering the ridges 16. The self-fluxing solder shown in Figures 5 and 6 incorporates a body 10 of solder in the form of a sheet which is rolled at both surfaces with a multiplicity of stud-like projections 18 separated by recesses 19. The projection of a stud 18 at one surface produces a recess at the other surface. Such a pattern of studs and recesses may be produced by rolling the sheet with two sets of parallel grooves set in criss-cross fashion. The recesses 19 are filled with flux 13 (Figure 6). The level of this flux may be such as completely to cover the tops of the studs.

With the example shown in Figures 7 and 8, round wire is rolled into the form of a strip, and one end of the straight strip is held fixed while the other end is rotated about an axis passing longitudinally through the middle of the strip. There is thus produced a twisted length of wire or rod 20 having a helical groove 21. During the twisting operation intermediate anneals may be required, depending on the constitution of the solder. After thus forming the body of solder 20 the grooves 21 are filled with flux 22. With the example shown, the level of the flux is such that the external surface of the solder wire is exposed. In a modification, the level of the flux may be such as to form a thin layer that completely covers the curved external surface of the solder wire.

The self-fluxing solder shown in Figures 9 and 10 is in the form of a wire shaped with two longitudinal grooves or flutes 23 which are set at diametrically opposite sides of the wire. The grooves 23 are filled with flux 22, which may or may not form a layer over the external surface of the wire.

Figures 11 and 12 show a strip 24 of solder which is formed at its two surfaces with a series of transverse grooves 25. The two sets of grooves are staggered. In the grooves is filled flux 26. The level of the flux is such as to leave the flat surfaces of the solder exposed; but the flux level may be increased so that a layer of flux completely covers the two surfaces of the solder.

In Figure 13 is shown a ring cut and formed from a length of the self-fluxing wire shown in Figures 7 and 8. Such a ring serves as a preformed component for making a soldered connection at an annular joint between two parts.

Figure 14 is a face view of a disc 30 made from self-fluxing solder in sheet form similar to that in Figures 5 and 6. One application of such a disc is illustrated in Figures 17 and 18. Two tubes 31, 32 have their ends telescoped one within the other. In the wall of the outer tube is made a hole 33, in which is fitted a disc 30. The position of the hole 33 is such that the disc 30 overlies the inner tube 31. When heat is applied, the molten

flux and solder run round the narrow annular space between the two tubes so as to form a joint.

In the further application illustrated in Figures 15 and 16, the outer tube 32 of two telescoped tubes 31, 32 is formed, as by spinning, at its end with a bead to form an annular chamber or groove 34 in the outer tube around the inner tube. In the groove or chamber 34 is expanded a ring 35 of the self-fluxing solder. This ring may be cut as a narrow strip from sheet material such as illustrated in any of Figures 1 to 6. When heat is applied and the two tubes are suitably tilted, molten flux and solder run into the joint between the two tubes.

Another application of the invention is illustrated in Figure 19. Here a stud 36 is formed at one end with a reduced portion 37 on which is sprung a cap 38 made from self-fluxing solder in strip form. The stud 36 is fixed in a hole 39 within a part 40 by applying heat so as to melt the flux and solder and thereby make a joint between the two parts.

A method of coating a recessed wire such as that shown in Figures 7 to 10 is illustrated in Figure 20. A wire 50 is fed continuously in the direction of an arrow into a bath 51 of flux paste. The wire passes out of the bath through a die 52 for wiping off surplus flux from the surface of the wire. Thence the wire passes through troughs 53, 54 and an intermediate die 55. The troughs 53, 54 contain powdered flux for drying the outside of the paste on the wire. Excess flux is removed by a die 56. Thence the flux coated wire passes through a bath 57 for applying polybutyl methacrylate lacquer over the flux. In the next step the wire passes through a heating tube 58 into which air passes through a duct 59, heat being applied by a suitable heater 60, so as to dry the lacquer.

A typical soft silver solder contains 96% tin and 4% silver, and melts at 224° C. A suitable flux for such a solder is zinc chloride. Alternative fluxes are salicylic acid, phthalic acid, benzoic acid, citric acid or a combination of these acids.

A typical hard solder contains 38% silver, 20% copper, 19% zinc, 23% cadmium and melts at 650° C. A suitable flux for such a solder consists of alkali fluorides, such as potassium or sodium mixed with boric acid or borax or both.

A thermoplastic resinous composition consisting of polybutyl methacrylate is a suitable vehicle for bonding together the flux particles and for causing them to adhere to the solder. The composition may include a plasticizer. A suitable plasticizer is dibutyl phthalate. To obtain a balanced thermoplastic composition, i.e. one in which the flux particles are evenly distributed throughout the composition, a suitable solvent may be added to the vehicle.

What we claim is:—

1. Self-fluxing solder comprising a solid body of solder formed with an external surface having a spreading recess or recesses, said recessed surface carrying an external body of adherent flux of solid or semi-solid consistency, which is distributed over the recessed surface so as to fill the recess or recesses therein, and which is alone sufficient in quantity to permit the making of a soldered joint with the solder, and a vehicle for bonding together the particles of flux and causing them to adhere to the solder body, the vehicle being of such a nature that it is stable in form and composition under normal temperatures, affords a stiff and durable body of flux under normal temperatures, and substantially all vaporizes when the soldering temperature is reached, any small residue not being deleterious to the joint to be made.

2. Self-fluxing solder as claimed in claim 1, wherein the body of solder is in the form of sheet or strip.

3. Self-fluxing solder as claimed in claim 2, wherein both surfaces of the solder sheet or strip are recessed to receive the flux.

4. Self-fluxing solder as claimed in either claim 2 or claim 3, wherein the recessing of the surface is afforded by a multiplicity of closely-spaced depressions extending over the surface of the solder body.

5. Self-fluxing solder as claimed in claim 4, wherein the recessed surface has the form of a dimpled surface made up of self-contained cells.

6. Self-fluxing solder as claimed in claim 4, wherein the recessing is afforded by a series of parallel grooves and ridges extending over the solder body.

7. Self-fluxing solder as claimed in claim 6, wherein at least two sets of parallel grooves and ridges are arranged to cross each other on the surface of the solder body.

8. Self-fluxing solder as claimed in claim 6, wherein the recessing is afforded by corrugating the sheet or strip.

9. Self-fluxing solder as claimed in claim 1, wherein the solder body is in the form of wire or rod.

10. Self-fluxing solder as claimed in claim 9 wherein the solder wire or rod is non-circular in section, and wherein the rod or wire is twisted about its axis to produce a co-axial spiral groove affording a

recess to receive the flux.

11. Self-fluxing solder as claimed in claim 9, wherein the recessing in the solder wire or rod comprises one or more longitudinal grooves.

12. Self-fluxing solder as claimed in claim 11, wherein the recessing in the solder wire or rod consists of two longitudinal grooves arranged at diametrically opposed sides of the wire or rod.

13. Self-fluxing solder as claimed in any one of the preceding claims, wherein the flux in the recess or recesses is at a level such that the recessed surface or at least a part of the recessed surface of the solder body is exposed.

14. Self-fluxing solder as claimed in any one of claims 1 to 12, wherein the quantity of flux carried by the solder body is such as to completely fill the recess or recesses and also to afford a flux layer covering the recessed surface of the solder body.

15. Self-fluxing solder as claimed in any one of the preceding claims, wherein the flux vehicle comprises a thermoplastic plasticized resinous composition.

16. Self-fluxing solder as claimed in claim 15, wherein the flux vehicle comprises polybutyl methacrylate, with or without a plasticizer, such as dibutyl phthalate

17. Self-fluxing solder as claimed in any one of the preceding claims, wherein the solder is preformed into a component shaped to the form of the joint to be made.

18. A self-fluxing solder component as claimed in claim 17, wherein the solder is shaped as a ring adapted to fit into an annular space at the joint between two mating parts such as two telescoped tubes that are to be joined by a soldering operation.

19. A self-fluxing solder as claimed in any one of claims 1 to 8 or claims 13 to 17, wherein the solder is preformed into a component shaped to the form of a disc adapted to be inserted in a hole of a part (e.g. a tube) to be joined to another and adjacent part (e.g. another tube) overlying the hole.

20. A self-fluxing solder as claimed in any one of claims 1 to 8 or claims 13 to 17. wherein the solder is preformed into a component shaped as a cap adapted mechanically to be fixed over the end of a stud or rod or the like for joining that end to another part by a soldering operation.

21. A self-fluxing solder or solder component substantially as herein described with reference to and as shown in Figures 1 and 2, or Figure 3, or Figure 4, or Figures 5 and 6, or Figures 7 and 8, or Figures 9 and 10, or Figures 11 and 12, or Figure 13, or Figure 14, or Figures 15 and 16, or Figures 17 and 18, or Figure 19 of the accompanying drawings.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.1,
Chartered Patent Agents.

PROVISIONAL SPECIFICATION
No. 8952 A.D. 1950.

## Improvements in or relating to Self-Fluxing Solders

We, THESSCO INDUSTRIAL RESEARCH LIMITED, a British Company, of Royds Mill Street, Sheffield, 4, Yorkshire, do hereby declare this invention to be described in the following statement:—

The invention relates to solders and the like, and is particularly concerned with solders, containing silver as an essential constituent. The principle object of the invention is to provide a self-fluxing solder, and comprises the step of providing an improved form of solder, which also enables the ratio of flux to solder to be controlled, improved methods of providing preformed self-fluxing solder parts, an improved method of providing the flux and applying the flux to the solder, and a form of self-fluxing solder, which makes electrical resistance soldering more efficient.

This latter method of soldering or brazing consists in the application of heat and pressure to the parts to be joined, between which the solder may be preplaced, using the heat generated by the flow of current. This heat is generated by the resistance to the passage of high current low voltage power generated in the secondary circuit of a resistance brazing unit.

The fluxes used are heat resisting and are insulators when cold, and solders which are provided with a surface coating of dry flux may cause an interruption in the flow of current.

In carrying the invention into effect, the solder in the form sheet, wire or rod, in a preferred form, may have indentations or cells, closely spaced together over the surface, of a depth and form, which

enables the amount of flux in relation to the solder to be controlled, and by varying the size of the receptacles formed in the solder, the flux can be varied, in relation to the weight of the solder, and the requirements of the soldering or brazing operation. These depressions may be formed by passing the sheet, wire or rod, through rollers on the surface of which are formed the impressions, to be transferred to the solder.

A feature of the invention consists also in the provision of self-fluxing solder parts, which may be preformed to varying shapes and sizes, such as discs, washers, rings, and the like, having innumerable indentations or cells of flux, and may take the size and shape of the joint to be made.

Automatic stamping presses may be used to preform the discs, washers, and the like from this solder sheet, and automatic forming machines to produce rings and the like, from solder wire.

A further feature of the invention comprises the step of providing a suitable flux, and a method of applying the flux to the solder.

The preferred method consists in carrying the flux in a vehicle, and for the purpose of soldering, both the flux and the vehicle must have distinctive properties.

A flux suitable for soldering must be capable of dissolving oxides that form during heating, assist in the free flow of the alloy solder, and reduce the surface tension of the molten solder in relation to the metal on which it flows, enabling the molten solder to " wet " the surfaces to be joined.

A soft silver solder, may be one containing 96% tin, and 4% silver, melting at 224 degrees C. A typical flux for this solder may be, zinc chloride, or one of the weaker acids, such as salicylic acid, phthalic acid, benzoic acid, citric acid, or a combination of these acids.

A typical hard silver solder, may be one containing silver 38%, copper 20%, zinc 19%, and cadmium 23%, melting at 650 degrees C. A suitable flux for this solder may consist of alkali fluorides such as potassium or sodium mixed with boric acid or borax or both.

The flux when carried in suspension or in solution in the vehicle, and applied to the solder, must when dry, adhere strongly to the solder, and must withstand bending, stamping, and handling during storage, distribution and in use, whilst giving protection against atmospheric influences.

Selected thermoplastic, plasticized, resinous compositions, may fulfil these requirements, but there are certain functions peculiar to, and essential in carrying out a soldering operation which must not be influenced or affected, and which renders, necessary particular treatment of these products.

This vehicle must be capable of mixing with, or taking into solution these fluxes, without forming a " Gel," and must not retard the function of the flux to reduce the surface tension of the molten solder in relation to the metal over which it flows, and further no residue deleterious to making a joint must be left when subject to heat during the soldering operation. In a soldering operation the solder may be preplaced in the joint to be made, and it is essential that the solder shall flow over the whole area of the joint, and that no residue must be left, which will weaken the joint.

The thermoplastic, plasticised, resinous composition, may be dibutyl methacrylate, plasticised with dibutyl phthalate, and this thermoplastic composition to produce the desired results in soldering, must be balanced. This can be achieved by the use of a suitable solvent, which when the vehicle is mixed with the flux, will form an adhesive and consistent paint product, without the tendency to " Gel." To ensure the free flowing properties and to assist the flow of the solder a distinctive hydrocarbon may be selected and added to the vehicle before mixing with the flux.

To further promote the free flowing of the solder by reducing surface tension minute particles of a metal or alloy may be carried in suspension in the flux and/or vehicle, which would volatilise, without influencing the chemical balance of the solder.

One of the milder acids such as citric acid may be further added to improve the adhesive properties to the solder of the flux laden vehicle.

The vehicle and the flux may be intimately mixed in a ball mill or other preferred method, and may be applied to the solder by any conventional method, such as dipping or spraying. It is however necessary to control the dimensions of the flux solder accurately, particularly where solder parts are used for preplaced soldering of joints. For example machined parts are produced to limits, and solder rings, washers and the like, must fit in and/or around these machined surfaces. The wire or rod may therefore be passed through a die, and the sheet may be passed through rollers, and where necessary, abrasion rollers or scrapers may be used, to ensure this accuracy of dimensions, and expose the solder metal surface of the ridges or apex formed by the

depressions in the solder metal.

The process of electrical resistance soldering is rendered more efficient by this method of producing self-fluxing solders, as the solder metal surface of the ridges or apex formed by the depressions, are exposed and in contact with the metal parts to be joined, and electrical and thermal conductivity is thus maintained between the opposing electrodes, sufficient flux for the soldering operation being carried in the depressions formed in the solder. Uniform and consistent soldering of joints is therefore made possible.

For certain soldering operations, a fine gauge wire is used, which makes the automatic forming of rings difficult, if not impracticable. The invention simplifies this process by enabling a heavier gauge solder wire or other section to be used, for a given weight of solder, the depressions formed in the solder, being filled with the requisite amount of flux, determined by the form and depth of the depression. The sections or patterns may also be such as to provide reinforcement and strength to the section.

The details of the invention may be varied, provided the principles of the invention are adhered to. Perforated sheet may be used, and transverse grooves may be formed in the wire, for example. The method of applying the flux may be varied, and may not be confined to the method described

JOHN COCKBAIN BRIGGS.

PROVISIONAL SPECIFICATION

No. 20291 A.D. 1950.

## Improvements in or relating to Self-Fluxing Solders

We, THESSCO INDUSTRIAL RESEARCH LIMITED, a British Company, of Royds Mill Street, Sheffield, 4, Yorkshire, do hereby declare this invention to be described in the following statement:—

The invention has for its object the improvement of fluxes and solders. Solders may be soft solders or hard solders, as used in soldering and brazing. An important object of the invention is to provide a self fluxing solder, and a method of producing a self fluxing solder in the form of pre-formed parts.

The application is a part of my invention, application No. 8952/50, and this application relates to a preferred method of producing self fluxing pre-formed parts from solder wire to form rings and other shapes to fit the joint to be brazed.

To carry the flux, which is an insulator, on the surface of a wire has limitations, and further the thickness of flux necessary on the surface of the solder wire makes the production of the formed parts in an automatic machine an uncertain operation.

Patent application No. 8952/50 describes a method of carrying the flux in predetermined relationship to the solder in cells, grooves or the like, and the invention now describes a preferred construction and method of manufacture of these preformed shapes of self fluxing solder.

To braze deep joints by self fluxing preformed parts shaped to fit the joints it has been found beneficial to provide means of directing the flux when molten into the joint to be brazed, and a further feature of the invention provides the solder wire in the form of preformed parts, such as rings with helical grooves spaced at a determined pitch, which direct the flux into the joint. The number of helical grooves for a given length of solder wire forming the preformed part, and the depth and/or width, may be varied, to enable the ratio of flux to solder to be altered to any predetermined quantity. This principle of carrying the flux in relation to the solder, also enables the flux to be released before the solder wets the joint surfaces, whiih may not occur if the flux is contained within the solder to form a core.

In carrying the invention into effect, the solder wire may be of any section, but preferably rectangular in form, and may be produced by passing a circular wire of the required length through rollers under pressure, or by forming the section by drawing through dies, or other suitable means. The wire may be in lengths of 1000 feet. In a preferred manner the coil solder wire may be twisted to form these helical flux carrying grooves in continuous length, in a machine on which may be mounted a spool or swift; for carrying this coil of solder wire. This spool simultaneously uncoils the solder wire and rotates. The rotating solder wire passes through a twisting chuck to a drum which controls the tension in the wire. The twisted wire from this drum is then continuously coiled on a rotating speed, or swift.

These long lengths of twisted wire may then be passed from the spool or swift through one or more enclosed baths, containing the fluxed medium described in

Patent application No. 8952/50, and through a sizing die, and before being coiled on a rotating spool or swift may be led through a heated jacketed duct, and dried.

In this process the spiral grooves in the twisted wire become filled with the flux medium.

The flux medium which is a feature of the invention is adhesive to the solder wire, sufficiently strong and resilient when dry to withstand bending, and forming shapes, as well as handling in industrial use without deterioration when exposed to moisture or other atmospheric influences. Further this fluxing medium may consist of a vehicle in which is dispersed the fluxing agent, such as the alkali fluorides and boric acid or borax and/or boric acid to form a uniform paint like product of suitable viscosity, but this vehicle must disperse and leave no residue, when the brazing operation has been completed, as described in Patent application No. 8952/50.

The fluxed solder wire in coils may be fed from the spool or swift to an automatic coiling machine on which perfectly formed, close jointed fluxed preformed parts such as rings may be formed.

For deep joints to be brazed, the ratio of thickness to width of the solder wire may be 2 to 1, and the number of twists per inch length of solder wire may be a minimum of 3, to provide an adequate supply of flux in relation to the solder. An example of this principle may be illustrated by taking a $\frac{1}{16}''$ dia silver solder wire, and passing this wire through rolls under pressure, to $0.08'' \times 0.035''$. The volume and weight of the solder remains unaltered, but when twisted, the diameter is 0.08", the difference being represented by the volume of the flux carrying helical flutes or grooves.

When formed in rings or other preformed shapes, these spiral grooves or flutes direct the flux when molten, into the jointed to be brazed.

Although a preferred construction and method of manufacture has been described, the invention is not restricted to this method, for example two wires may be woven together to form helical grooves or flutes along its length, by conventional machines, continuously in long lengths, or other methods or forms may be used, provided the principles of the invention have been adhered to.

JOHN COCKBAIN BRIGGS.

PROVISIONAL SPECIFICATION

No. 26599 A.D. 1950.

## Improvements in or relating to Self-Fluxing Solders

We, THESSCO INDUSTRIAL RESEARCH LIMITED, a British Company, of Royds Mill Street, Sheffield, 4, Yorkshire, do hereby declare this invention to be described in the following statement:—

This invention concerns improvements in or relating to the inventions forming the subject of my prior patent applications Nos. 8952/50 and 20291/50.

The main object of the invention is to provide means for facilitating the operation of soldering together two or more metal parts to form a composite structure.

According to the present invention there is provided a metal part prepared for soldering to a second part which is fitted at the surface to be joined to another part with a pre-formed solder-flux component mechanically secured to the metal part so that the metal part and the component together form a unit capable of being soldered at the jointing surface to the second metal part.

Where the two metal parts each have the form of a sleeve or tube and are adapted to be engaged within or over one another for soldering together between the adjacent surfaces, one of the parts may be formed with an annular groove at the jointing surface which is adapted to receive a solder-flux component in the form of a ring.

In a modification, the groove is replaced by a hole passing through the wall of either the inner or outer sleeve or tube, but preferably in the outer tube, and this hole is adapted to receive a plug consisting of the solder-flux component. Instead of the hole there may be provided a circular or other shaped recess to receive the solder-flux plug.

If the metal part is in the form of a stud or rod or the like, of which an end face is adapted to be joined by soldering to another metal part, the solder-flux component may have the form of a cap that is fixed over the end of the stud or the like so as to cover the surface to be joined. Thus the cap may be pressed or sprung into position. A very convenient form of cap has a flange which is serrated or fluted and is pressed around a beaded portion around the end of the stud or the like.

The invention particularly, although not exclusively, relates to hard solders. In

carrying the invention into practice, the solder-flux component may be made from material which is in the form of sheet, strip, wire and rod. Thus the solder may be formed with cells containing flux of an adhesive character distributed over its surface, such as is afforded by depressions or corrugations or grooves in sheet either alone or in combination. Where the solder-flux component is made from wire, the grooves for receiving the flux may be formed in the surface of the wire by twisting that wire so as to produce a helical groove or spiral.

The size and shape and spacing of the cells or other recesses is so adjusted as to provide the finished solder-flux component with sufficient flux for completing the brazed or other soldered joint.

By varying the size, shape and spacing of the cells or other depressions, the solder flux ratio can readily be varied to meet circumstances; and in addition they serve as a key for the flux below the surface of the component, protecting the flux from disturbance or injury during transit and use. The flux may extend as a thin layer over the whole surface of the solder-flux component, so as to completely cover it. However, for certain brazing operations such as electrical resistance brazing where the electric current must be transmitted through the solder to the parts to be joined, it is then necessary that there shall be no surface coating of flux; and the tops or peaks of the sides of the depressions in the surface of the solder are then left exposed and free from flux.

It is already known to provide sleeve-like unions for joining two tubes with a soft solder ring which is formed in a groove within the union; but such solderings are not made up into solder-flux components; and moreover such solders are plastic and can be pressed or forced into the grooves within the unions. This is not possible with hard solders, since they are not plastic. With the solder-flux components disclosed in my two prior patent applications Nos. 8952/50 and 20291/50, the cellular or grooved or like structure of the solder permits its being readily deformed under pressure to fill a recess, such as a groove at the position where the joint is to be made. Thus a union for joining two pipes may be provided with grooves which are sprung with preformed solder-flux components in the form of rings. The arrangement is such that the bore of the union, after insertion of the solder-flux components, is such as to permit free entry of the tube or tubes within a union. Where the solder-flux component is in the form of a ring retained within an annular groove in the union and it protrudes when initially fed into the bore of the union, an expanding tool may be passed through the bore or the union so as to press the ring into the groove to bring the exposed surface of the ring flush with the bore of the union.

Several constructions in accordance with the present invention will now briefly be described by way of example.

A common method of securing a stud to another part is to drill and tap a hole in that part for receiving a screw-threaded portion at an end of the stud. This fixing method may be considerably simplified by fitting the end of the stud with a solder-flux component in the form of a cap which is pressed or sprung on or otherwise secured over the end of the stud so as to form an integral part of that stud. The stud and its cap then form a unit ready for use by the user. The end of the stud that carries the cap may be inserted within a plain hole in a part or placed in contact with the surface of the part to which it is to be secured, and it can then readily be brazed into position to another metal part.

In another construction, the solder-flux component may be in the form of a disc or plug which is pressed into or otherwise secured in a recess or hole at the surface where the metal part is to be joined to another metal part. Thus, where one metal part is in the form of a sleeve or tube fitted over another part in the form of a sleeve or tube or the like, the outer sleeve is formed with a circular or other shaped hole for receiving a solder-flux component in the form of a disc or plug. In a modification, the disc or plug was received in a recess at the surface of the bore of the sleeve or the like.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.1,
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1953.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.